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Lubrication

A Technical Publication Devoted to
the Selection and Use of Lubricants

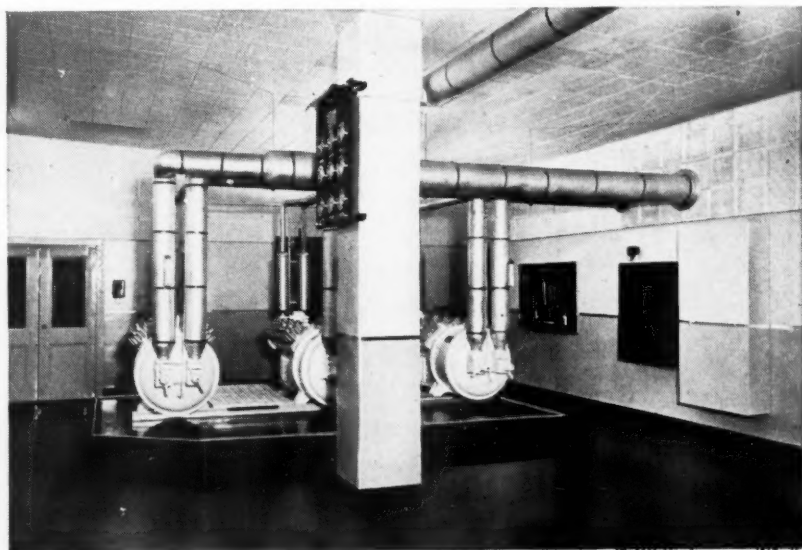
THIS ISSUE

PUBLIC BUILDINGS

The Machinery They
Require to Operate



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TEXACO PETROLEUM PRODUCTS



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GOOD theatre "box office" often begins down in the compressor room of the air conditioning system — a spot the audience never sees.

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FOR ALL AIR CONDITIONING AND REFRIGERATING EQUIPMENT

LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

Published by

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PUBLIC BUILDINGS

The Machinery They Require to Operate

THE next time you are waiting in line in the lobby of some busy hotel, wondering whether you'll get a room that night, take a moment to think of the variety of machinery which has been installed for your comfort. The lobby is warm in cold weather, perhaps your room will be air-conditioned. High speed elevator service takes you up or down in a moment; the lighting is excellent; the linens spotless.

Full speed ahead in industry has contributed to the scarcity of accommodations for more trips are necessary for business men than ever before. Add to this congestion, the thousands of service people on short leave from their military duties who wish to spend a night in town. It's a load which has made its weight felt by the hotel personnel as well as the mechanical equipment. The former can gripe about it; the latter just runs along delivering power, light, transpor-

tation and comfort if it is properly maintained and effectually lubricated.

The hotel is but an example. Include the department store, theatre, apartment and office building, and one will find an assembly of mechanical equipment is involved in any large city which would dwarf the production line in many industries.

Heat, light, transportation and comfort are benefits which have become so acceptable that most of the general public who are benefited in their daily contact with public building operations take these benefits for granted. Few of us ever stop to think about what is below the lobby level of our apartment or hotel; where the ice water comes from; why the elevators in the mid-town stores

run so smoothly; what operates the escalators or what makes our favorite restaurant so cool on a hot summer day.

WHAT WE HAVE

Heat
Light
Air Conditioning
Refrigeration
Laundry Service
Elevators
Escalators
Dining Rooms

HOW WE GET IT

By Combustion of

Coal
Oil Fuel
Gas

And by Operation of

Steam Engines
Turbines
Diesels
Gasoline Engines
Electric Generators
Compressors
Motors and Fans
Washing Machines
Pumps

Krug Urges Machinery Care

From the Herald Tribune Bureau

WASHINGTON, March 22.—

Julius A. Krug, chairman of the War Production Board, appealed today to householders, automobile owners, farmers and mechanics to lubricate all machinery to keep it running through the war. "It is urgent that every precaution be taken to protect and lubricate home-front machinery. . . . Replacement of parts rusted or made useless through carelessness means diversion of equipment from the battlefronts," he said.

HEAT, LIGHT AND POWER

Heat, Light and Power stem from Fuel. They are essential to the operation of any public building. People can walk upstairs, they can drink tap water, or swelter in warm weather, but they must read, and they must be kept warm in cold weather — otherwise, no sale.

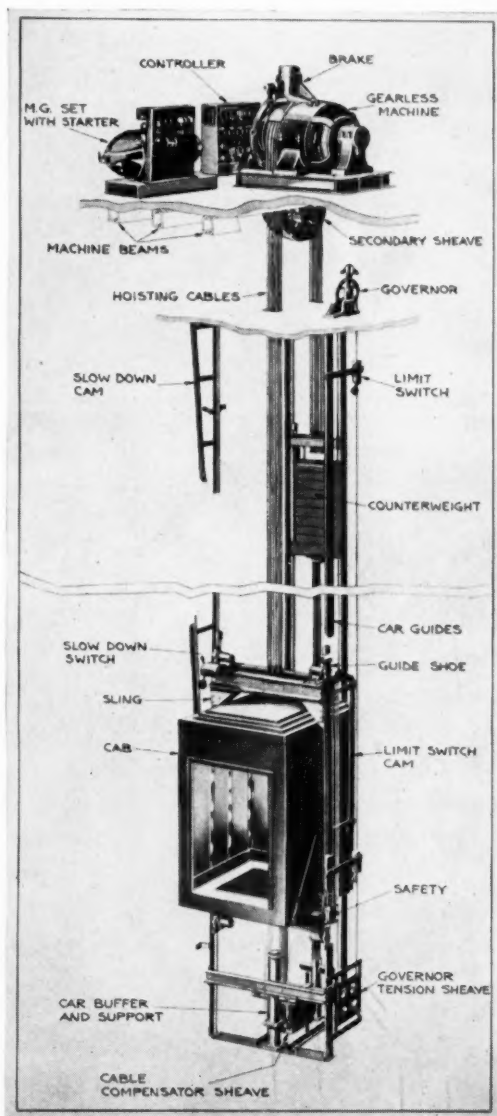
The fuels used for heat, light and power depend upon the locality. In some northern states it is largely coal; in the Southwest, natural gas; in the Midwest, oil fuel. All are burned under steam boilers of varying design to generate the steam required for heating and the operation of steam engines, turbo-generators, pumps and compressors. In addition, natural gas is burned directly in gas engines and lighter petroleum products such as gasoline and Diesel fuels are burned in these respective types of engines as direct prime movers. This is the source of energy which is out of sight in every modern public building today.

Auxiliary to the prime movers are the machines run by the electric power which is developed by the generators; motors, blowers, fans, pumps, speed reducers, air compressors, refrigeration and air-conditioning compressors; elevators, escalators, sidewalk hoists, laundry machines, baking ovens. The basement of a modern public building contains a power plant often as extensive as in a manufacturing factory, yet there is no stack, no smoke, no coal pile, no oil storage tank and *no noise or smell*. Nothing in evidence except the comforts derived therefrom. In the course of a year, such an assembly of machinery consumes a considerable volume of lubricants. Quality is a primary requisite, for dependable lubrication of the machinery means a satisfied clientele who want more heat today; more light tomorrow; or rush the elevators the next day.

ELEVATORS AND ESCALATORS

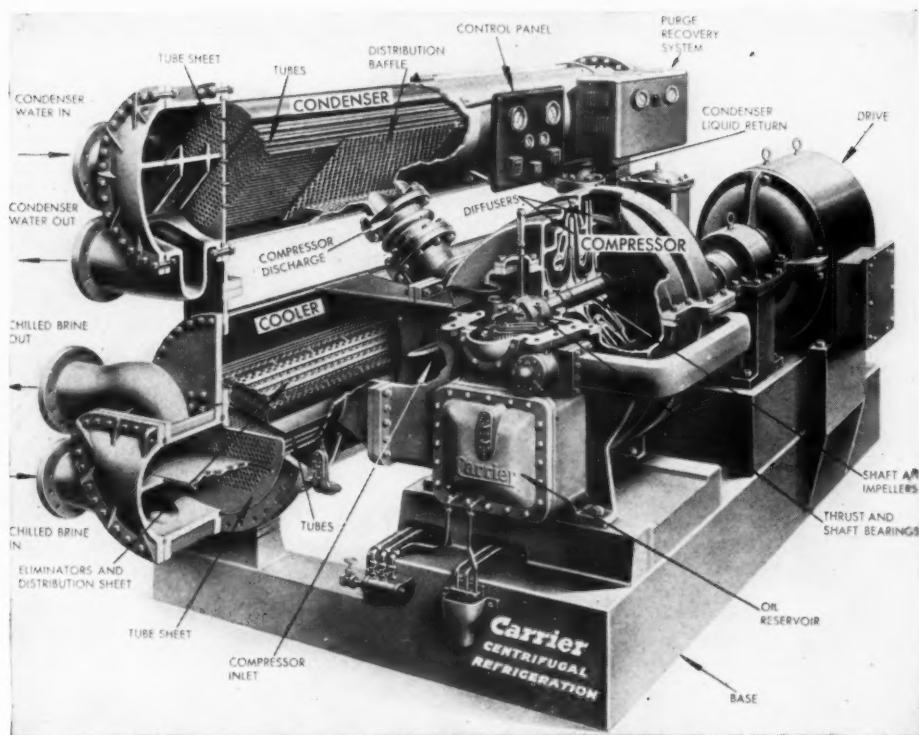
People walked up and down stairs till the first passenger elevator was built in 1857, just about two years before the birth of the petroleum industry. By that time the apartment idea and the multi-floor hotel had evidenced their values in city housing.

The use of one building to house a number of families in individual homes is said to have started in Paris during the 18th Century. Hotels, their coun-



Courtesy of "Mechanical Engineering" and Westinghouse Electric Corporation.

Figure 1—Details of a typical gearless traction passenger elevator as discussed by E. M. Bouton, Manager of Engineering, Westinghouse Electric Elevator Company and presented at the Annual Meeting of The American Society of Mechanical Engineers, New York, New York, December 1 to 5, 1941.



Courtesy of Carrier Corporation

Figure 2—Details of a Carrier Centrifugal Refrigeration Unit.

terpart for transient visitor accommodation, date back of course to the inns of the Middle Ages. Both were a necessary evil when creaky stairs, candlelight, open grate fires and the old fashioned wash bowl prevailed. With the development of modern conveniences, it was natural that the modern structures we are so familiar with today should follow.

The elevator contributed in a large measure to this transition. The modern elevator to the layman is nothing more than a cage hanging from a steel cable. The operator moves a lever, or you push a button and in a few seconds the car stops at the desired floor. Reverse all this when you want to go down.

Then along came the escalator, that mysterious traveling stairway which starts from one floor, ends at another and seems to fold into itself. The electric escalator which is so familiar to patrons of the modern department store, followed the perfection of the electric elevator as a means of expediting one or more floor handling of passengers in a continuous stream without the necessity for attendants or the time lost in opening and closing doors.

The modern escalator is a slow speed machine for it must permit passengers to step on or off without chance of falling. It may well be likened to an inclined conveyor equipped with stair treads which

form themselves automatically as they come into position on the rising or descending approach.

Safety Must Be Assured

Elevators in particular, involve equipment which concerns the safety of the public. In the development there is an interesting analogy to the development of the petroleum industry. As the elevator industry discarded hemp rope in favor of wire rope the petroleum industry met the situation with lubricants suited to protection of the strands against rust, corrosion and wear; when worm reduction gears were perfected, compounded gear lubricants were made available; when guide rail lubrication concerned the elevator industry lubricating engineers cooperated in the study, all to the ultimate benefit of the passengers, their safety, their comfort and the protection of their clothing. For second to the discomfort of climbing stairs was the knowledge that inferior lubricants might drip through the top of the car to spoil a hat or ruin a costly gown or coat.

These requirements of safety, comfort and cleanliness, coupled with the load conditions which developed as buildings of greater height were constructed, imposed a definite obligation on the elevator designer, the maintenance engineer and the lubrication specialist. It called for their joint con-



Photo by Ewing Galloway, N. Y.

Figure 3—Panoramic view of New York City looking eastward, showing some of the principal public buildings.

sideration of elevator lubrication as one of their primary problems. That such a procedure would pay dividends was emphasized by the fact that effective lubrication would lengthen the life of materials.

In other respects it must be realized that few other types of machinery involving the same mechanical principles operate under such severe conditions where starting and stopping under load is continuous. In the geared traction elevator where the worm has to exert a starting torque about three times the normal, load conditions of this nature may readily

be so severe as to cause some lubricants to be squeezed entirely out from between the contact parts they should be protecting.

Details of Lubrication

For those who may wish to read in more detail about elevator lubrication, we presented an article on this subject entitled "How Elevator Developments Have Paralleled Petroleum" in LUBRICATION for January 1938. Therein we discussed Transition in Design, Lubrication Procedure and showed nu-



Figure 4—San Francisco, showing the main business district.

Photo by Ewing Galloway, N. Y.

merous views which illustrate a considerable variety of elevator mechanisms.

ICE REFRIGERATION AND AIR CONDITIONING

Refrigeration is that process whereby heat is removed to create a *cold* condition. Nero, of Roman fame, is recorded as one of the first users of ice as a refrigerating medium. He employed an army of slaves to transport ice and snow from the Appennine Mountains to cool the wines and preserve the rare viands which were so popular at the banquets of the rich Romans in those days.

Later, someone discovered the insulating value of cork, saw-dust, hay and straw; then cold storage was made possible. The old-fashioned ice house followed. Here ice, cut from ponds and lakes in the winter could be stored until it was needed in warm weather. Insulation and ice led to the ice box which later became a refrigerator when the stylist developed new ideas in design. Up to this time no machinery was involved — manpower and horses were depended upon.

In 1873, however, Linde and others developed a machine which would use ammonia as an adjunct to refrigeration. This was the ammonia compressor. The basic principles of compression are so fundamental that the idea in our modern mechanical refrigerator is virtually the same as that which prevailed in the first ammonia compressor.

When machinery entered the field of refrigera-

tion, lubrication was required. Unless the compressors functioned satisfactorily — no ice. Control of the refrigerant also is very important. The process of refrigeration follows a cycle in which chemicals are used which are in the form of a gas during part of the cycle. If they leak out when under pressure somebody moves out — should the chemical be ammonia or sulfur dioxide.

So the refrigeration engineer designed a system which is noteworthy for its tightness, its economy of refrigerant material and the remarkably small amount of lubricating oil required. The electric refrigerator in your apartment kitchen, for example, contains about a pint of oil, and runs on this for years. In the basement the refrigeration system for the whole building, which enables you to draw ice water in the bathroom, runs on the same kind of oil.

Close the Windows to Keep Cool

When steam heating came into popularity in the latter part of the nineteenth century, it was found that very often the air in the rooms thus heated was very dry, causing furniture to come apart and making people susceptible to colds. It was such an improvement over grate fires or wood burning stoves, however, that people forgot these objections in favor of the more apparent comforts. After that it was not long before someone thought of evaporating water to moisten the air, just as the simmering kettle used to do on the back of the kitchen stove.

This was the earliest form of air conditioning. It

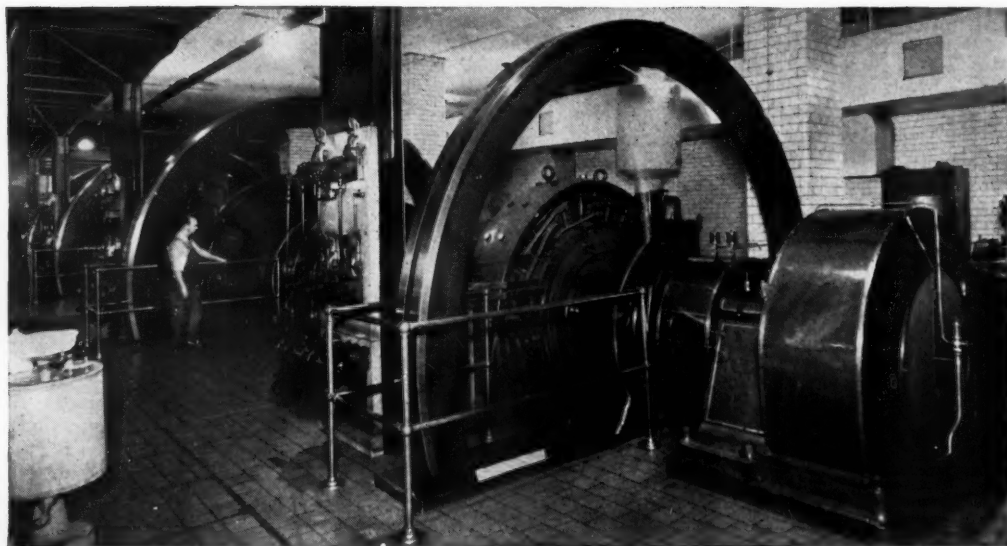


Photo by Irving Underhill

Figure 5—Below the street level in one of New York's principal office buildings is located a most complete power plant.

worked fairly well in winter when the furnace was on, but in warm weather there was no other alternative than to open the windows and hope for a breeze.

A lot of growing industries were developing at that time. Subways were being planned and tall buildings designed. Subways required ventilation; skyscrapers had to be heated. So a phase of engineering involving heating and ventilation became very active. It was only natural that after the engineer had learned how to circulate fresh air and to control its temperature, that he should try to make it most comfortable. So he studied humidity or the water-vapor content. He found he could control this by spraying water into the air, or by evaporation. The former became adaptable where large volumes of air had to be handled, but evaporation of water from pans was most economical in small spaces.

This was fine in cold weather when the steam was turned on, but even a lot of air in circulation was not quite comfortable in July or August. When we opened railway car windows, we had an excellent example of this, for if the air was dry and hot, even if it blew a gale through the car it didn't quite cool us. Furthermore, we often caught colds due to these drafts.

So another phase of engineering began to study our comfort. This involved refrigeration. At the turn of the century it was quite possible to make ice and chill cold storage rooms. If the engineer could do this latter, why not cool the air before it was circulated in railway cars, in public buildings or in our homes. It was a happy thought and led to a lot of research. It became very active after the first world

war. Two sources of cooling were studied. One requiring circulation of air over cakes of ice in an insulated storage cabinet; the other requiring the use of refrigerating machinery and cooling coils. Both are in use today in highly perfected form.

All this circulation of air requires very careful control. Unless air can be taken in from a controlled source and its flow regulated into the spaces to be comfort-cooled, the objectives cannot be attained. With such a system we no longer open doors or windows for ventilation. It is best to have them weather-stripped and closed. This reminds us of an amusing incident.

On a particularly hot day in August, a couple of years ago, a young riot was almost brewed on one of the trains for the south when two unbelieving passengers scoffed at the air-conditioning poster at the end of the car, and insisted on opening their windows. It required the combined physical efforts of three trainmen to calm them, and a lecture on air conditioning to convince them that open windows defeated the purpose of a considerable investment, which was to keep them cool.

In other words, satisfactory comfort cooling by conditioned air can only be assured if the air is kept under control and uncontaminated. The modern system provides for such circulation, with make-up air drawn in from the exterior through suitable filtering media. The moment a window is opened the entire cycle is disrupted. Obviously, the same thing occurs when the car or house doors are left open—that's why air conditioning engineers advise their being kept closed and opened only momentarily when necessary.

Meanwhile, in the railway car or movie (as the case may be), our air is being cooled by refrigerating means, washed or filtered, and then circulated by fans or blowers through scientifically designed ducts which are planned to avert drafts and maintain a uniform comfortable temperature.

Why Lubrication Is Important

For the reader who desires to study the principles of lubrication as involved with Refrigeration and Air Conditioning Machinery our booklet on "Selection of Lubricants in Refrigeration Service" is available. It tells how refrigeration is obtained, discusses the characteristics of the various refrigerants in use today, advises on how to select refrigeration machinery lubricating oils and presents a lot of detail illustrations which show what the inner workings of most of the popular machines look like.

AIR POWER, VENTILATION AND VACUUM CLEANING

All these involve the circulation of air under pressures differing more or less from the normal air pressure. Indirectly air is used as a source of power. It is of value to the building management from three angles; i.e.,

- (a) As a medium for driving small air tools which are used around the engine room for minor repairs.
- (b) For quick ventilation by forced draft, so to speak.
- (c) For vacuum cleaning by utilizing the principles of suction.

Utilization of air power is not a new idea; it has held a certain fascination for the research scientist since the days of antiquity when those predecessors of modern science discovered that wind power could be applied to sails for moving boats. Later they discovered that air under pressure could be put to other uses. Probably the most notable was the development of the reed type of musical wind instrument which subsequently led to the invention of the pipe organ.

All this occurred prior to the Christian era. The use of air as an adjunct to mechanics was not taken up until the seventeenth century when Galileo discovered that air had weight. Crude types of air pumps were then developed at intervals. The air compressor and high volume blower followed when steam power and the electric motor were made available as the drive.

To attain the objectives outlined above in public building operation, the air compressor is employed to raise the pressure of the air so that it can subsequently be used as a power medium; the vacuum pump which is a form of air pump, is used for removing air from a suitable tank or space so that the pressure therein will be reduced. Here is where the suction comes from which operates the vacuum cleaners in a multi-cleaning unit, via suitable piping to the various hallways, etc. Then all the operator has to do is plug in the cleaning hose. The idea is the same as in a unit household cleaner, only it is done on a large scale with a central collecting space for the dust and dirt which is gathered.

A lot of labor is saved in the modern public building by air power. The broom and the dustpan

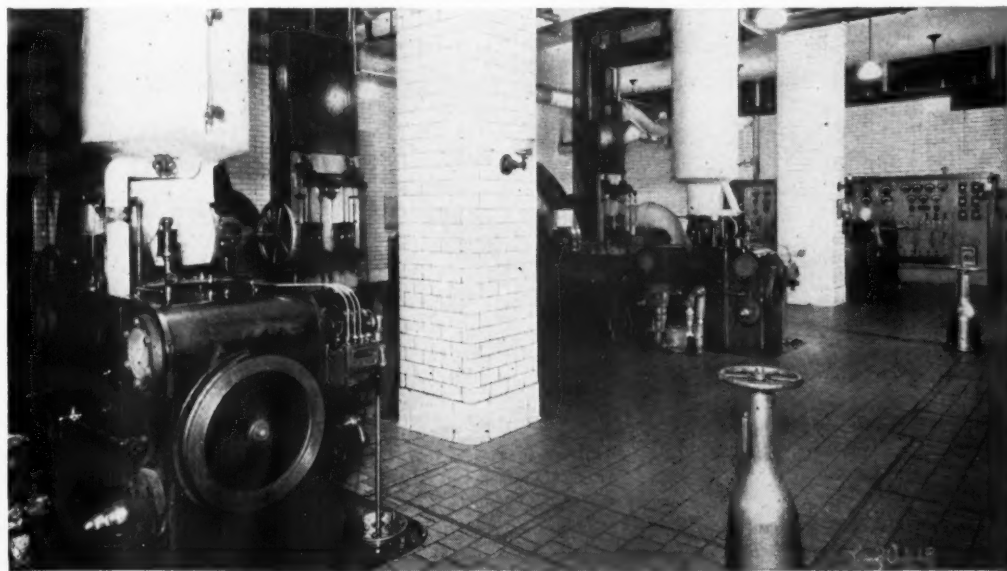


Figure 6.—Another view of the power plant shown in Figure 5.

Photo by Irving Underhill

are often just "props" in the life of the progressive cleaner. A lot of headaches may accrue to the engine room personnel, however, if they don't realize the importance of lubrication. For air power machinery involves another type of apparatus (like refrigeration) which gets along best on little oil. Give a compressor too much and very likely some day it will balk due to an excess of carbon accumulations. When it does, there will probably be no air power handy to operate a chipping tool. It will have to be done by hand.

All this may occur because in the compressing of air heat is developed. It is caused by the rapid increase in the rate of impact between the molecules of the air which composes the charge being compressed. Actual friction contributes but little to the total amount of heat developed. Normally, most of the actual machine friction will be dissipated by radiation or conduction. All this does not imply, however, that the air compressor is a heat engine, for the heat developed during compression is largely removed from the compressed air by cooling before it is used.

Obviously, the machinery required to compress air must be lubricated. Furthermore, it must be lubricated at fairly high temperatures, for the heat of compression is not removed until after discharge. The pistons, cylinder walls or vanes according to the type of compressor run hot accordingly. Air compressor cylinder oils, therefore, must be capable of withstanding heat with minimum tendency towards carbon formation.

More About Lubrication

"Air Power and Compressor Lubrication" in LUBRICATION for January 1940, and "Electric Motor Bearings" in our April issue of that same year tell a lot more about the problems which confront the operator in planning for effective lubrication of his compressors, motors, blowers and fans. The factors which can control efficient operation are discussed in detail. The illustrations tell a story all by themselves.

PUMPS

On the roof of practically every large public building there is a water tank. Sometimes this tank is in plain view — in other instances it may be located under the building dome or peak. In very high buildings there may be a number of such tanks located on various floor levels. A water tank serves a utility as well as an emergency purpose to furnish water to the floors below under uniform pressure and to provide a stand-by source of water in case of fire. Down below in the basement adjacent to the city water main are the pumps which must pump water to this tank. Sometimes they are steam driven,

sometimes electric motor drives are used.

Pumps are often called the work-horses of the power plant. They do a lot of hard work without much fuss; if properly lubricated they don't use too much power; like Old Man River they just keep running along most dependably. There's no temperament involved.

Man learned to pump water more than 2,000 years ago. The art of placing fluids in motion dates back to that age of Greek and Egyptian civilization which antedated the Christian Era by several hundred years. It was very soon appreciated that power was a necessity; obviously the first steps in this direction were toward the use of animals or man in the turning of crude water-wheels. Steam did not become a factor until late in the 18th century after Watt had developed the steam engine; electricity was not used until a century later.

During this phase of the industrial revolution, a variety of reciprocating, rotary and centrifugal pumps were developed. Originally they were designed for pumping water; with the advent of the Petroleum Industry, however, they were proved equally applicable to crude as well as distilled oils.

As mentioned, pumps must be properly lubricated. On the reciprocating steam driven pump this means lubrication of the steam end — in reality a form of steam cylinder lubrication, with auxiliary lubrication of the rocker arms and guides. On the rotary or centrifugal pump the engineer is concerned only with the lubrication of the bearings. These he services just as he does the bearings of the driving motor, with oil or grease according to the design and construction of the bearing.

Pumping Operations, Their Relation to Lubrication

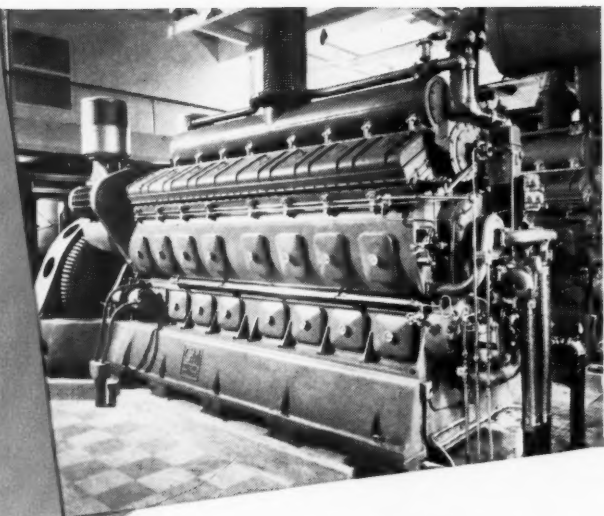
This was the title of the March 1938 issue of LUBRICATION. The several types of pumps commonly used today were discussed in this article with emphasis on design and its bearing on choice of lubricants.

CONCLUSION

With this brief, non-technical discussion of the principal machinery which makes our modern public buildings tenantable, it is hoped that we have aroused sufficient interest on the part of those who are of a technical mind to wish to study further.

It is fascinating to visit the power room or elevator machinery level in any modern public building; to see the quiet efficiency of the operators; the simplicity which the designers have built into their machinery; to hear of the tens of thousands of people who are carried or served in the course of a year.

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- ★ assure clear ports
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- ★ are designed for each type of Diesel

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Experience of operators everywhere has proved that Texaco Ursa Diesel lubricants prevent scuffing, ring sticking, sludge and corrosion; increase life

of rings, pistons, liners and bearings. Because of these benefits —

More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

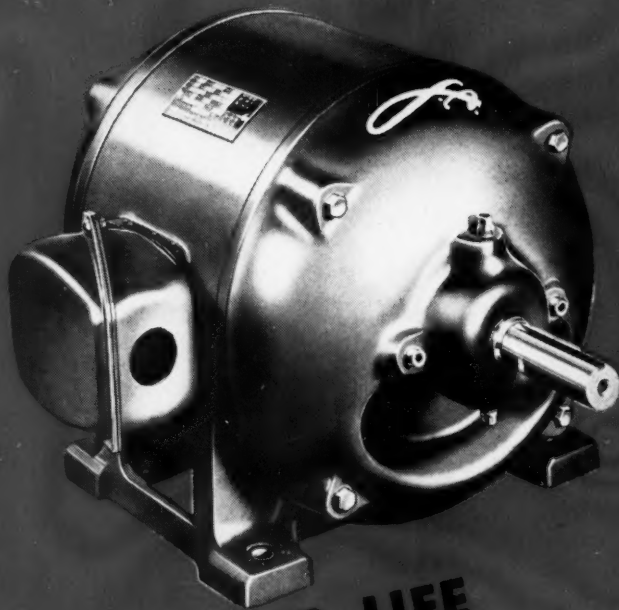
A Texaco Lubrication Engineer, specializing in Diesel lubrication, is available to recommend the most suitable grade and type of Texaco Ursa Diesel lubricant for your engine. Get in touch with the nearest of more than 2300 Texaco distributing plants in the 48 States, or write to The Texas Company, 135 E. 42nd St., New York 17, N. Y.



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Texaco Regal Starfak has exceptionally high resistance to oxidation, gum formation, separation and leakage. As a result, it stays in the bearing longer, retains its full lubricating efficiency. In addition, *Regal Starfak* reduces starting

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